

McNUTT, (W.F.) 2

MINERAL AND THERMAL SPRINGS

OF

CALIFORNIA.

BY

W. F. McNUTT, M.D.,

M.R.C.S.; ECT. L.R.C.P.; ECT. PROFESSOR PRINCIPLES AND PRACTICE
OF MEDICINE, UNIVERSITY OF CALIFORNIA; ETC.

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NOTES ON THE MINERAL AND THERMAL SPRINGS OF CALIFORNIA.

NOTES SUR LES EAUX MINÉRALES ET THERMALES DE CALIFORNIE.

ÜBER DIE MINERAL- UND WARMBRUNNEN CALIFORNIENS.

BY W. F. McNUTT, M.D., M.R.C.S., ED., L.R.C.P., ED.,

Of San Francisco, California.

Prominent among the various elements which contribute to California's fame as a great sanitarium are her numerous mineral and thermal springs. Scattered throughout the State, from the southern boundary to Oregon, and from the ocean to the Sierras, more than two hundred localities are known, where waters, varying in temperature from 27° to 212° F., and charged with salts and gases of high therapeutic value, pour forth from the earth in great profusion. The number of individual springs in different localities ranges from one to thirty, each varying in composition, temperature and possibly other, as yet, undetermined physical qualities. Although the general character of most of these springs is known, only a few of them have as yet been carefully analyzed, and at still fewer have patients been under a competent observer's care, so that with the insufficient data at hand, and the limited time at the writer's disposal, it was found impossible, during the two weeks intervening between the notice that a paper on this subject was desired and the date of mailing, to attempt more than to briefly call the attention of this Congress to the great number and diversity of medicinal waters found in California, and to give the analysis of a few of the most frequented springs.

In the southern portion of the State, close to the Mexican line, we find on Warner's Ranch, fifty miles from San Diego, a number of thermal sulphur springs, known as *Agua calientes*.

There are said to be seven springs in all, varying in temperature from 58° to 142°. They flow from small openings in a ravine, and bubbles of sulphureted hydrogen are



continually escaping. At one orifice a jet of steam issues with a hissing sound. The water has a pleasant acid taste, but no analysis has yet been published. These springs enjoy a greater reputation among the native population for the cure of syphilis than any others, and have enjoyed this reputation since the settlement by the Americans.

Other springs in this country are the *Temescal Hot Springs*, *De Luz Hot Springs* and the *Springs of Dos Palmas*, the latter being saline and having a temperature of 80°. Near Elsinore there is, according to the *San Diego Union*, a wonderful little valley containing mineral springs of hot and cold water, sulphur, soda, white sulphur, magnesia, iron, borax, hot mud, fresh water, etc.—one hundred and eighty-six springs in all. The *San Bernardino Hot Springs*, further inland, in San Bernardino County, are calcic and form a deposit or incrustation on twigs and pebbles which is snow white. The temperature is from 108° to 172°, the waters gushing out from crevices in the granite rock in sufficient quantity to raise the temperature in a small stream near by to 130° F., the water so heated being ample to constitute an efficient water power. The altitude of these springs is about sixteen hundred feet above the sea.

Arrow Head Hot Springs, at an altitude of over two thousand feet, and consisting of a number of springs, varying in temperature from 140° to 210°, first came into notice in 1858. An artificial pond for bathing has been prepared, the dimensions of which are one hundred by seventy-five feet. There are mud baths also which are deemed of great value in cutaneous diseases.

Among the mineral and thermal waters found in this region are the *Anti-fat Springs*, *Bear Valley Hot Springs*, *Borax Marsh Springs*, *Borax Patch Springs*, *Salt Wells*, *Soda Lake* and *Waterman's Springs*.

Fulton's Sulphur Wells, two in number, now called the *Santa Fé Springs*, thirteen miles from Los Angeles, yield a water containing per gallon—

| | |
|----------------------------|--------------|
| Sodium bicarbonate..... | 2.20 grains. |
| Magnesium bicarbonate..... | 16.50 “ |
| Calcium bicarbonate | 12.00 “ |
| Iron subcarbonate | 13.00 “ |
| Sodium sulphide..... | .90 “ |
| Sodium chloride..... | 10.40 “ |
| Sulphur..... | 23.00 “ |
| | <hr/> |
| | 78.00 “ |

In addition the water is strongly charged with carbonic acid and sulphureted hydrogen gases. The *San Juan Hot Springs* enjoy a great local reputation, especially among the native Californians, for the cure of rheumatism.

The *Santa Barbara Hot Sulphur Springs*, seven in number, are located about five miles to the northeast of Santa Barbara, at an elevation of fifteen hundred feet. They seem to be of two distinct varieties. Those nearest to the cañon escape from crevices in the rock and are four in number, all appearing to have the same properties, the most sensible of which are free sulphur, held in suspension, and sulphureted hydrogen; their temperature is 114°.

Another spring, situated about one hundred yards off, in a westerly direction from the first mentioned, contains sulphate of alumina, the under surface of the rock beneath which this water escapes being covered with a thick incrustation of this salt.

It also tastes strongly of sulphate of iron, and is said to contain soda, potassa, and a trace of arsenic.

Other springs in this county are the *Las Cruces Hot Sulphur Springs*, *Mountain Glen Hot Springs* and *San Marcos Sulphur Springs*.

As worthy of mention is an immense petroleum spring, some ten miles in a westerly direction from Santa Barbara, situated in the bed of the ocean, about one and a half miles from shore, the product of which continually arises to the surface of the water, and floats upon it over an area of many miles.

Dr. Brinkerhoff suggests that the prevailing westerly sea breezes passing over the vast expanse of sea-laden petroleum may take up from it and bear along with them some subtle power which serves as a disinfecting agent, and which may account for the superior healthfulness of the climate of Santa Barbara.

The *Paso de Robles Thermal Springs*, five in number, ranging in temperature from 110° to 140°, are situated in San Luis Obispo county, and are among the most valuable springs in the State.

The following analysis shows the composition of two of the springs:—

| | MAIN SPRING, 112° Fah. | MUD SPRING, 122° Fah. |
|---------------------------|------------------------|-----------------------|
| Sodium carbonate..... | 3.664 grains. | 0.543 grains. |
| Magnesium carbonate..... | 0.057 “ | 0.323 “ |
| Sodium chloride | 2.830 “ | 10.047 “ |
| Potassium sulphate..... | 0.092 “ | Trace. |
| Sodium sulphate | 0.818 “ | 4.281 “ |
| Calcium sulphate..... | 0.334 “ | 1.864 “ |
| Iron protoxide..... | 0.037 “ | |
| Iodides and bromides..... | Traces. | |
| Alumina | 0.023 “ | |
| Silica..... | 0.046 “ | 0.116 “ |
| Organic matter..... | 0.171 “ | 0.361 “ |
| | <hr/> 8.072 “ | <hr/> 17.535 “ |
| Carbonic acid..... | 2.31 cubic inches. | 10.53 cubic inches. |
| Sulphureted hydrogen..... | saturated. | saturated. |

These springs are situated in a valley on the northern slope of the Santa Lucia Mountains, and are well appointed.

There are over twenty sulphur baths and a mud bath. Numerous other springs are scattered throughout the country. There are a number of springs both in Kern and Tulare county, of which, however, we have no reliable information.

Inyo county abounds in mineral and thermal waters. The *Thermal Acid Springs*, situated in the Coso Range, are of rare and remarkable composition, one hundred thousand parts containing—

| | |
|---|---------------|
| Free sulphuric acid..... | 78.4 parts. |
| Potassium sulphate..... | 2.5 “ |
| Sodium sulphate..... | 15.1 “ |
| Calcium sulphate..... | 15.3 “ |
| Magnesium sulphate..... | 1.2 “ |
| Aluminium persulphate..... | 127.0 “ |
| Iron persulphate..... | 33.2 “ |
| Nitric acid, chlorine, ammonia and lithium. | Traces. |
| | <hr/> 272.7 “ |

The waters have but a limited flow, and from crevices in the mountain side, through which steam is continually ejected; and thousands of tons of pure sulphur cover the surrounding locality, deposited there in former times, when the water must have contained large quantities of sulphureted hydrogen.

Owens Lake is another remarkable body of water, containing per gallon—

| | |
|-------------------------|-----------------|
| Sodium chloride..... | 2942.15 grains. |
| “ sulphate..... | 956.80 “ |
| “ carbonate..... | 2914.43 “ |
| Potassium sulphate..... | 35.74 “ |
| “ silicate..... | 139.54 “ |
| Organic matter..... | 16.94 “ |
| | <hr/> |
| | 7005.60 “ |

This lake, then, is more than twice as salt as the Atlantic Ocean.

Volcanic Mineral Springs, situated in Death Valley, contain per gallon—

| | |
|--|-----------------|
| Sodium chloride..... | 1840.72 grains. |
| Potassium chloride..... | 132.30 “ |
| Sodium carbonate..... | 1724.11 “ |
| “ sulphate..... | 651.02 “ |
| “ sulphide..... | 46.34 “ |
| Lime and magnesia..... | Traces. |
| Silica..... | 14.28 “ |
| Organic matter..... | 13.48 “ |
| Iodine, bromine, iron, boracic and phosphoric acids..... | Traces. |
| | <hr/> |
| | 4422.25 “ |

Other springs in this county are the *Boiling Springs*, *Castilian* and *Saratoga*. The last mentioned springs are said to be located at the south end of Funeral Range, south of Death Valley—certainly rather suggestive names for the location of a health resort.

The *Paraiso Hot Springs*, Monterey county, situated at an elevation of twelve hundred feet above the valley, range in temperature from cold to 118°. They are saline, one gallon containing—

| | |
|-------------------------|--------------|
| Organic matter..... | 5.25 grains. |
| Silica..... | 2.62 “ |
| Alumina and iron..... | 1.60 “ |
| Magnesia..... | Trace. |
| Potassium chloride..... | 0.35 “ |
| Sodium chloride..... | 3.50 “ |
| “ sulphate..... | 35.50 “ |
| “ carbonate..... | 4.23 “ |
| Calcium carbonate..... | 1.43 “ |
| “ sulphate..... | 4.32 “ |
| | <hr/> |
| | 58.80 “ |

Of the *Tassajara Hot Springs* in this county we have no reliable information, nor of the *Fresno Hot Springs* in the adjacent county of that name.

In Mono county are found a number of mineral springs and lakes, the most remarkable of which is *Mono Lake*, which, in many of its features, resembles the Dead Sea of the Holy Land. It lies in a depression, in a desert basin, which was, probably, in ancient times, an extensive volcanic crater, and from which can be traced streams of volcanic lava, which flowed in several directions.

The water of this lake is strongly saline, containing, it is said, nearly 11,000 grains to the gallon of chlorides of sodium, potassium, calcium and magnesium, with traces of other salts and free acids

Santa Clara county has been highly favored in the distribution of springs. Among the most valuable are *Pacific Congress Springs*, situated twelve miles west of San Jose. The water is alkaline, saline and chalybeate, containing 335,857 grains of solid matter to the gallon, consisting of—

| | |
|------------------------------------|-----------------|
| Sodium chloride..... | 119.159 grains. |
| “ sulphate | 12.140 “ |
| “ carbonate..... | 123.351 “ |
| Iron carbonate | 14.030 “ |
| Lime carbonate..... | 17.295 “ |
| Silica, alumina and magnesia | 49.882 “ |
| | <hr/> |
| | 335.857 “ |

The temperature of this water is 50° F.

The *Azule* is an excellent alkaline-saline water, containing a large amount of free carbonic acid gas, which renders the water very pleasant to the taste. One gallon contains—

| | |
|--------------------------|----------------|
| Carbonic acid..... | 152.24 grains. |
| Sodium chloride | 90.88 “ |
| Magnesium chloride..... | 18.48 “ |
| Potassium chloride..... | 12.44 “ |
| Magnesium carbonate..... | 77.20 “ |
| Sodium carbonate..... | 50.88 “ |
| Calcium carbonate..... | 9. “ |
| | <hr/> |
| | 411.12 “ |

Vichy Springs, of New Almaden, is another excellent alkaline-saline water, containing to the gallon—

| | |
|-------------------------|----------------|
| Sodium carbonate..... | 200.12 grains. |
| Calcium carbonate..... | 32. “ |
| Calcium sulphate | 40.20 “ |
| Magnesium sulphate..... | 12. “ |
| Sodium chloride..... | 32.16 “ |
| Carbonic acid..... | 112.08 “ |
| Iron | 4.08 “ |
| | <hr/> |
| | 432.64 “ |

Gilroy Hot Sulphur Springs is another popular resort. The temperature of the water is from 109° to 116°. It is said to contain sulphur, magnesia, iron, arsenic and iodine. No reliable analysis has, however, been made, as far as I know.

The *Alum Rock Springs* are saline and sulphureted. A careful analysis is wanting.

The *Summit Soda Springs* are located near the summit of the Sierra Nevada, in Alpine county, at an altitude of 6090 feet above the sea. One gallon of the water yields—

| | |
|---------------------------|----------------------|
| Calcium carbonate..... | 43.20 grains. |
| Magnesium carbonate | 4.20 “ |
| Sodium carbonate | 9.50 “ |
| “ chloride | 26.22 “ |
| Iron oxide..... | 1.75 “ |
| Silica..... | 2.06 “ |
| Alumina | 1.75 “ |
| Potassium | Trace. |
| | <hr/> |
| | 88.68 “ |
| Carbonic acid..... | 186.36 cubic inches. |

The water is clear, cold and sparkling, and constantly more or less agitated by escaping carbonic acid.

Byron Springs, Contra Costa county, are gaining considerable reputation. There are fourteen springs, differing both in temperature and chemical constituents. They range from cold to 135°. One spring, called "Surprise," is both cathartic and emetic in half-ounce doses. It is said to contain chloride of sodium and sulphate of magnesium in large amounts. Some of the springs are sparkling with carbonic acid, others contain sulphureted and phosphureted hydrogen gas; also hot mud baths.

The proprietor is now having all the springs analyzed.

Tolenas Springs, in Solano county, nineteen in number, alkaline-saline, and contain free carbonic acid gas.

The *Geysers* and *Little Geysers*, situated in Sonoma county, consist of a large number of springs, ranging in temperature from 190° to 212°. At present they are visited as objects of curiosity rather than a health resort, though many of the springs are said to possess active therapeutic qualities.

Litton's Seltzer Springs contain boracic, carbonic, hydrochloric, sulphuric and silicic acids, in combination with alumina, ammonia, iron, lime, silica, magnesia, potassa, soda and organic matter in proportion of 228.69 grains to the gallon.

Skaggs' Hot Springs, three in number, varying in temperature from 128° to 140°, are alkaline. One gallon contains—

| | | |
|---------------------------|---------|---------|
| Potassium sulphate | 0.260 | grains. |
| Potassium chloride | 0.200 | " |
| Sodium chloride | 5.900 | " |
| Sodium iodide | Trace, | |
| Sodium bicarbonate | 161.670 | " |
| Sodium biborate | 26.470 | " |
| Lithium carbonate | 0.060 | " |
| Barium carbonate | 0.240 | " |
| Strontium carbonate | 0.024 | " |
| Calcium carbonate | 2.197 | " |
| Magnesium carbonate | 11.113 | " |
| Iron carbonate | 0.054 | " |
| Alumina | 0.004 | " |
| Silica | 7.023 | " |
| | 215.215 | " |

The *Napa Soda Springs*, twenty-seven in number, having a temperature of 68°, are situated on the mountain side, a thousand feet above the rich and beautiful Napa Valley. The climate and scenery are unsurpassed, and the accommodations for visitors are excellent, the cottages being of stone cut from the lava beds of the mountain, and the grounds arranged with much taste and at great expense. One gallon of the water contains—

| | | |
|---------------------------|-------|---------|
| Sodium bicarbonate | 13.12 | grains. |
| Magnesium carbonate | 26.12 | " |
| Calcium carbonate | 10.88 | " |
| Sodium chloride | 5.20 | " |
| Iron subcarbonate | 7.84 | " |
| Sodium sulphate | 1.84 | " |
| Silicious acid | 0.68 | " |
| Alumina | 0.60 | " |
| Loss | 2.48 | " |
| | 68.76 | " |

It is an excellent table water.

Etna Springs, thermal (98° and 106°), alkaline, and charged with carbonic acid. One gallon contains—

| | |
|--------------------------|-------------|
| Sodium carbonate..... | .75 grains. |
| Magnesium carbonate..... | .14 “ |
| Calcium carbonate | .10 “ |
| Sodium sulphate | .08 “ |
| Sodium chloride | .29 “ |
| Silica..... | Trace. |

1.36 “

Carbonic acid..... 58 cubic inches.

The *St. Helena White Sulphur Springs* are saline-sulphur waters, mildly aperient. *Calistoga Hot Springs*, twenty in number, saline and sulphureted, with a temperature ranging from 97° to 186°, are situated in the town of that name in Napa county. Twenty miles from there are the *Harbin Springs*, saline, chalybeate and sulphureted; temperature 118° F.

Lake county possesses a great number of valuable springs. *Adam's Springs*, alkaline and carbonated, contain about 200 grains to the gallon, the principal constituents being carbonate of magnesia, soda and lime with silica, chloride of sodium and a small amount of iron.

Allen's Springs, five in number, temperature of water 50°, alkaline, saline and chalybeate. They are highly charged with free carbonic acid gas.

Anderson's Springs, nine in number, hot and sulphureted.

Bartlett Springs, cold, alkaline-saline, also said to contain arsenic.

Bonanza Springs, three in number, cold, sulphureted and chalybeate.

Highland Springs, a popular resort, situated among highly picturesque surroundings, forests, lakes and mountains.

There are ten springs known by different names, as “Magnesia Spring,” “Dutch Spring,” “Magic Spring,” etc. The water is cold, 60° to 82°, alkaline, and highly charged with carbonic acid. The following analysis gives the number of grains per gallon of three of the principal springs:—

| | SELTZER. | DUTCH. | MAGIC. |
|-------------------------------|----------|--------|--------|
| Sodium carbonate..... | 8.87 | 12.72 | 15.10 |
| Magnesium carbonate..... | 20.67 | 40.08 | 41.63 |
| Calcium carbonate..... | 34.76 | 39.80 | 35.02 |
| Potassium carbonate..... | 0.38 | 0.58 | 0.42 |
| Manganese carbonate..... | Trace. | Trace. | Trace. |
| Iron carbonate..... | 0.92 | 0.98 | 0.78 |
| Sodium chloride..... | 0.72 | 1.68 | 1.28 |
| Alumina..... | 1.56 | 0.11 | 0.17 |
| Silica..... | 5.24 | 7.12 | 7.39 |
| | 73.12 | 103.07 | 101.79 |
| Carbonic acid (cub. in.)..... | 212.20 | 184.30 | 156.80 |

Hot Borate Spring. This spring pours out 18,000 gallons of water per hour. It is alkaline-saline, and is said to contain large quantities of potassium, ammonia, bromine and borax.

Howard Springs are situated at an altitude of 2225 feet. They are fourteen in number, hot and cold, temperature ranging from 58° to 109°. They are saline, chalybeate and highly charged with carbonic acid.

Iodine Springs, situated at the entrance of Grizzly Cañon, contain iodine in considerable quantities.

Ziegler Springs, at an elevation of 2500 feet, is a popular resort. The waters, both hot and cold, are alkaline and chalybeate. One spring is said to contain arsenic.

Witter's Springs, sulphureted and chalybeate, are situated in the coast range of mountains, and have considerable reputation as yielding healing waters.

The *Tuscan Springs*, Tehama county, saline and sulphureted ; also said to contain iodine.

An, as yet, unnamed spring, said to have been known to the Indians, who ascribed to it remarkable curative powers, has recently been discovered in Eureka, Humboldt county. The water issues from the bank at the head of the bay and at high tide the waters of the bay cover the spring. It is a strong saline-sulphur water, containing also a small amount of free carbonic acid. One gallon contains:—

| | |
|--|-----------------|
| Sodium chloride..... | 1403.00 grains. |
| Magnesium chloride..... | 101. “ |
| Magnesium sulphate..... | 211.30 “ |
| Calcium sulphate..... | 42.50 “ |
| Sodium bromide | 14. “ |
| Potassium sulphate | 12.20 “ |
| Sodium carbonate..... | 10.10 “ |
| Calcium carbonate..... | 3.80 “ |
| Silica | .95 “ |
| Iron carbonate..... | .12 “ |
| Manganese, boracic acid, iodine, lithium | Traces. |
| | 1798.97 “ |
| Sulphureted hydrogen..... | Saturated. |

The *Soda Springs*, in Shasta county, situated at an altitude of 236 feet, are strongly chalybeate, the water, as it runs from the springs, depositing an extensive bed of iron. There are a number of springs, both hot and cold, in this county, about which, however, reliable information is yet wanting.

Lassen county is full of hot (boiling) springs, having a temperature from 200° to 212°.

In all the northern counties mineral and thermal springs abound, though but little has, as yet, been done to popularize and develop them.

It will readily be seen from the foregoing that the composition of our mineral waters compares favorably with that of the most celebrated springs of Europe. Some of our chalybeate waters, for instance, contain more than twice the amount of iron found in the strongest European springs.

In the thermal acid springs of Coso Range, Inyo county, the iron is in the form of persulphate, about 19 grains to the gallon. The water, it will be remembered, contains also a large amount of persulphate of aluminium, and free sulphuric acid, a rare combination, which it is believed will prove highly efficacious in the treatment of many diseases, where iron and astringents are indicated.

Our hot springs are rich in sulphureted hydrogen and other sulphides, which materially enhance their value in the treatment of syphilis, rheumatism and cutaneous affections. Most of the alkaline and saline waters are highly charged with carbonic acid gas, rendering them agreeable to the taste and easily tolerated by the most sensitive stomach. The silica contained in some of the waters is supposed to impart to them a smoothness of texture or “unctuosity,” a term applied to that peculiar quality of certain waters which give to the body, when immersed, a sensation as if covered with a bland oil. It is, however, held by some that this is due to organic matter.

At the urgent request of the State Medical Society and the State Board of Health, a State analyst has been appointed, whose duty it is to examine all waters in equal quantities, and on one uniform plan.

Professor Rising, of the State University, now fills this position, and we may soon hope to obtain positive knowledge regarding the composition and physical qualities of all the mineral springs of California, that is, when the State Legislature will sufficiently appreciate the importance of the work and make the necessary appropriation; and

when this shall have been supplemented with sufficient clinical observations, carefully recorded and generalized, then, and not till then, may we hope to be able to apply intelligently, and efficiently in the treatment of disease these powerful remedial agents, which, prepared in nature's own laboratory, are furnished to us in such abundance.

To make no higher claim for our springs than that they are equal to those of any other country, will, with the advantages of the climate of California, render them the more efficient.

